



TM70 Handheld Wireless Remote Control System

User Manual

U003.5-TM70_HH_SYS-R

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FCC Statements

15.19 – Two Part Warning

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference and**
- (2) This device must accept any interference received, including interference that may cause undesired operation.**

15.21 – Unauthorized Modification

NOTICE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

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CAUTION



The instructions in this manual **must** be read carefully and strictly adhered to in order to:

- install and use the system properly
- keep it in working condition and
- reduce the risks of misuse.

Do not use this system on machines used for lifting people.

Do not use this system in potentially explosive atmospheres.

Any use other than that specified in this manual is **DANGEROUS**.

Welcome to Cervis

Thank you for choosing the TM70 Wireless Remote Control. We here at Cervis believe you have purchased one of the most reliable industrial radio control systems available. Specializing in wireless remote controls for mining and industry, we offer you over 60 years of combined machine control experience. We custom design and manufacture control systems for OEM's worldwide. We are dedicated to our customers' success—your needs, paramount to our success, have allowed us to become a leading innovator of wireless machine control technologies.

We are honored to have served some of the most demanding and rewarding customers in the world over the last 15 years. Called upon to solve the most challenging radio remote control problems in the industry, our systems have earned a world-wide reputation for affordability, superior engineering, ruggedness, and reliability.

Our goal is to provide our customers with the safest, most reliable wireless radio remote control available at an affordable cost. And to meet our goal, we develop and use the highest level, proven state-of-the-art technology backed by unparalleled customer support. Our systems increase our customers' safety and productivity—no matter how demanding the environment.

We are extremely pleased to have you as a customer, and we thank you for your purchase.

1.0 TM70 System Description

A standard TM70 system is comes complete with:

- One (1) Transmitter – either a TM70/1 or a TM70/2
- One (1) R70 Receiver
- One (1) CB70 Battery Charger
- Two (2) BT06K Batteries
- One (1) Antenna (internal or external)

The battery operated TM70/1 and TM70/2 push-button style transmitters are designed for the remote control of industrial equipment. An operator using a handheld transmitter can determine the safest location from which to carry out an operation. The receiver is connected to the electrical system of the machine to be operated. Table 2 below lists the Main Specifications of the TM70 system.



Figure 1. TM70 System Components with a TM70/1 Transmitter



Figure 2. TM70/2 Transmitter Layout

Table 1. TM70/02 Transmitter Component Descriptions

Figure 2 Reference	Component
1	IR Range Limiter (optional)
2	LCD (optional display)
3	Diagnostic LED
4	Two-step pushbuttons
5	Maintained or spring return rotary switch
6	Safety key switch (Power ON/OFF)
7	Warning/Start switch
8	CAT3 Stop switch
9	Shock absorbers
10	Portable EEPROM
11	Battery

Table 2. TM70 Main Specifications

TM70		
Frequency band	914.150 – 915.875 MHz	ERP < 1mW
Response Time	100 ms	
Temperature Range	0 to 150 °F (-20 to 65 °C)	
T70/1 and T70/2 Transmitters		
Protection	IP65	
R70/13 and R70/21 Receivers		
Power Supply	48, 115, 230 VAC ± 10% -- 50/60 Hz	
Optional	12 or 24 VDC	
Consumption	20 mW	
Relays	230 VAC/8A	
STOP Relays	230 VAC/6A	
Protection	IP65	
Electrical Security	Class II (EN50178)	
CB70 Battery Charger		
Power Supply	12/24 VDC, 115 VAC	
BTO6K Batteries		
Voltage	4.8 V	
Capacity	750 mAh NiMH	
Charging Temperature	+41 to +95°F (0 to 35°C)	
Battery Life	16 hrs. @ 15% duty cycle	

2.0 Safety Instructions

CAUTION



*These instructions **must** be read carefully in order to install and use the system properly, to keep it in safe working condition, and to reduce the risks of misuse.*

Do not use this system on machines used for lifting people.

Do not use this system in potentially explosive atmospheres.

Any use other than that specified in this manual is DANGEROUS.

Strict adherence to the following instructions is a MUST.

✓ **Note:** *To comply with FCC RF exposure compliance requirements, this device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.*

2.1 What You MUST Do

- **Strictly adhere** to the installation instructions contained in this manual.
- Make sure that professional and competent personnel carry out the installation.
- Make sure that all site and prevailing safety regulations are fully followed.
- Make sure that this manual is **permanently available** to the operator and maintenance personnel.
- Keep the transmitter out of reach of **unauthorized personnel**.
- **Remove** the transmission key when the transmitter is not in use.
- At the beginning of each work day, check to make sure that the **Stop Button** and other safety measures are working.
- When in doubt, press the **Stop Button**.
- Whenever several systems have been installed, make sure the transmitter you are about to use is the right one. **Identify** the machine controlled by the transmitter on the transmitter label (customer supplied).
- An **audible or visual warning device** indicating the machine is electrically active and that the transmitter has control should be installed on the machine.
- **Service** the equipment periodically.
- When carrying out repairs, only use parts supplied by Cervis dealers.

2.2 What You MUST NOT Do

- **Never** make changes to the system that have not been studied and approved by Cervis.

- **Never** power the equipment with anything other than with the specified power supply.
- **Never** allow unqualified personnel to operate the equipment.
- **Never** leave the equipment **ON** after use. Always use the **ON/OFF Key** or the **Stop Button** to avoid accidental movements.
- **Never** use the system when visibility is limited.
- **Never** abuse the transmitter. Avoid dropping.
- **Never** use the system if failure is detected.

3.0 System Component Installation

3.1 Transmitter Battery

CAUTION

THE BATTERIES MUST BE INITIALLY CHARGED BEFORE USE. Batteries must be charged for a full twelve (12) hours before they can be installed in the transmitter. Using a battery before initially charging will shorten its life span and can possibly result in an immediate degradation of service.

✓ **Note:** You must fully charge the batteries before installing and using in the transmitter. It takes twelve (12) hours to initially charge or recharge an exhausted battery. Once a battery is charged, do NOT charge it again until the transmitter indicates a low charge. You will shorten the battery life by charging it before it is exhausted. To guard against disruption of service, be sure to have one battery fully charged or in the process of being fully charged while the other is in use at all times.

Upon initial start-up, place a fully charged battery in the transmitter. Continue to use it until the transmitter LED slowly flashes red. The flashing LED indicates you have approximately five (5) minutes of operation until the transmitter automatically shuts down (see Topic 0 Use the following instructions to properly operate the equipment:

1. Attach the harness to the transmitter to prevent the equipment from falling.
2. Make sure of the transmitter you are going to use. Verify that the machine you want to operate matches the transmitter identification label—the label allows the operator to identify the machine before starting the equipment.
3. Install a fully charged battery into the transmitter.
4. Make sure all command controls are in the neutral position. All the command controls associated with active motions must be in the neutral position (inactive) to enable the transmitter.
5. Turn the **ON/OFF key ON** (clockwise) to enable the transmitter.
6. Pull out the **Stop Button**. The LED should pulse green telling you the transmitter is ready for use.

✓ **Note:** If you find that the Stop Button is already pulled out, you must push it in and then pull it out again. This sequence permits proper operation of the Stop circuit. If the unit has experienced a time-out auto-disconnect, it is not necessary to repeat the Stop Button procedure; instead, push and hold the **START Button** for one (1) second.

7. Press and hold the **START Button**. This activates the warning/start alarm if one is installed on the crane/machine and indicates to you the receiver is under your control.

8. The green LED should light indicating that the transmitter is now transmitting. Now when any of the transmitter command pushbuttons are pressed, the corresponding motion is activated.
9. Press the **Stop Button** or turn the **ON/OFF Key** counter clockwise to turn the transmitter **OFF**.

Battery Level Monitor). If the Stop Button is pushed during the time the LED is flashing, all control functions immediately cease and the transmitter will not start again until a fresh battery is installed. It is recommended to put the machine you are controlling in a safe state or safe place during this five minute warning so that it will not pose a hazard while you are changing the exhausted battery with a fully charged battery.

CAUTION

If the STOP button is pushed during the time the LED is indicating an imminent shutdown, be aware that the transmitter will not restart until a fresh battery is installed. Be sure to place the machine your are controlling in a safe state or place during the warning period so that it does not pose a hazard while the battery is being changed.

Under normal duty cycles, you can expect approximately 10 to 16 hours (cumulative) of actual usage before a battery is exhausted and needs to be recharged. An exhausted battery will take approximately 12 hours to become fully charged.

✓ **Note:** *A battery can be left on the charger for extended periods of time without damage to either the battery or the charger.*

3.2 CB70 Battery Charger

The CB70 battery charger, Figure 3, has two charging compartments that can simultaneously charge two batteries. Battery types BT06K (TM70 transmitter battery) BT06, BT12, and BT20K can be charged in any combination using the charger.

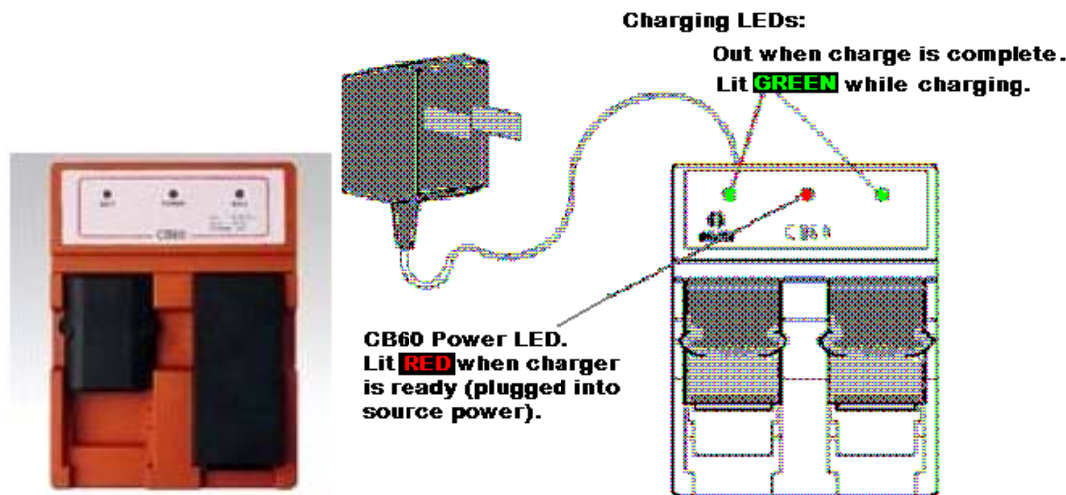


Figure 3. CB70 Battery Charger

✓ **Note:** The Charging LED lights when the battery is first seated in the cradle indicating the battery is properly seated and is charging. The Charging LED goes out after when the battery is charged.

1. Connect the charger to the proper power source using adaptor supplied for your system.

When installing the battery charger, bear in mind that the batteries must be charged at temperatures over 41°F (5°C) and that the power supply must be left for the entire time that it takes to charge, without interruption. Also remember that the charger must not be left in direct sunlight as the batteries will not become fully charged at temperatures exceeding 95°F (35°C).

2. Place the batteries in the charger. The LED's should illuminate indicating that recharging is in process. Complete recharging takes 12 hours. Batteries may remain in the charger for an unlimited period of time after they are fully charged.

If the LED does not illuminate when the battery is seated for charging, there is an improper connection. Remove the battery from the charger, check that the terminals are clean and unobstructed, and reseal the battery firmly in its cradle; check to see that the LED is on. *Should this fail, contact Cervix Customer Support.*

The capacity of the batteries decreases with use. Their life span is estimated to be 500 recharging cycles, but this depends largely on the conditions of use, for which the following is recommended:

CAUTION



Only use batteries certified by Cervix. When the batteries are exhausted, they should be safely disposed of or recycled according to local regulations.

3.2.1 Charging Tips

- Do not recharge the battery until it is completely flat (fully discharged). The transmitter indicates when the battery is nearing a charge cycle when the LED flashes red; this also indicates the transmitter will switch OFF in five (5) minutes. See Topic 0 below.
- Always charge the batteries at temperatures between 41°F and 95°F.
- Avoid short-circuits between the battery contacts. Do not carry charged batteries in toolboxes or next to other metal objects (keys, coins, etc.).
- Always keep the contacts clean.
- Never leave batteries in direct sunlight.

CAUTION



Never carry batteries in your pockets with other metal objects where a short across the terminals may occur resulting in burns or injuries.

3.3 Receiver Installation

CAUTION



Make sure the machine on which the receiver is to be attached is disabled while during installation.

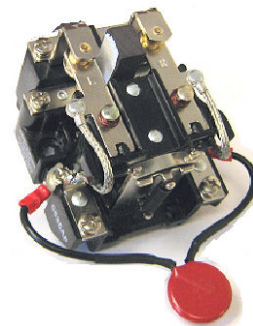
*Turn off the main line disconnect switch. Check the power supply voltage. **MAKE SURE THE POWER SUPPLY IS OFF.***

For a crane, park the crane and position the end stops at a suitable distance so that other cranes on the same runway do not hit it. If end stops are not available, use appropriate signs instead.

Keep the work area free from unnecessary clutter.

Wear protective clothing.

- ✓ **Note:** Before installing the receiver, make sure that the outputs diagram supplied with the system is available.
- ✓ **Note:** Installations subject to vibration should install the optional Shock Absorber Kit part # 1166074 available at Cervis. The kit has four absorbers that you place between the receiver and the mounting surface as per the kit directions.
- ✓ **Note:** Always mount the receiver and antenna away from any intense radio or electric disturbance sources.
- ✓ **Note:** When using contactors with the system, it is advisable to use the MOV's provided by installing them across the coil of the contactors as shown in Figure 4.



**Figure 4: Typical MOV Wiring
Across Contactor Coil**

✓ **Note:** If necessary, it is possible to improve signal reception by using the extension cables and external antenna kit. See Figure 6 below.

1. Find a suitable location for the receiver with clear access to the transmitter radio signal. Figure 5 below shows the footprint of the receiver and illustrates the distance between the mounting holes.

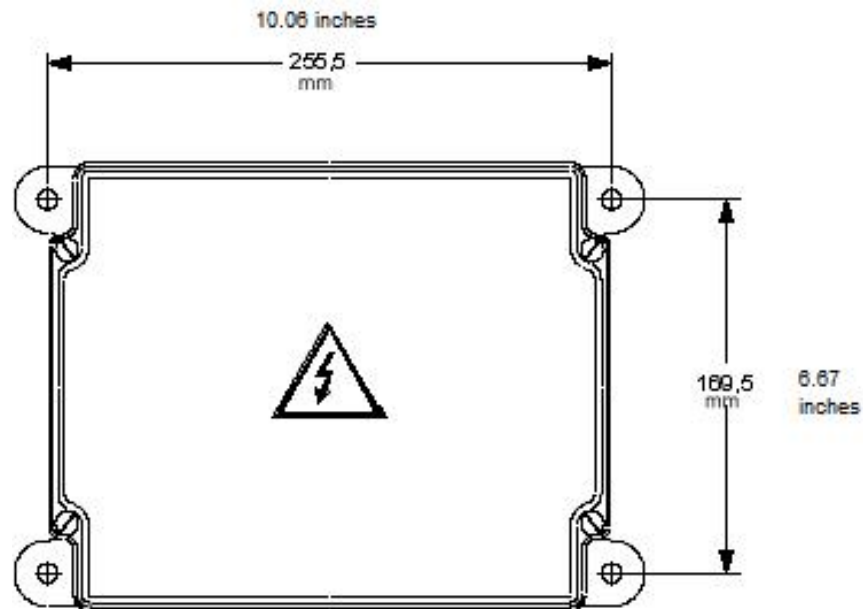


Figure 5. Receiver Footprint



J501 (Antenna) J502 (Cable) J503 (Bracket)

Figure 6. Receiver Antenna with Extension Kit

2. Follow the Outputs Diagram supplied with the system to connect the power supply and the receiver outputs on the relay board plug-in terminals. The Output Diagram indicates the relationship between the transmitter commands and the receiver outputs.
 - The **STOP** relays **K15** and **K16** are in series and must be connected to the main contactor coil circuit.
 - The **K2/START** is activated once the Warning/START command is held down.
 - The **K1/SEC** relay is a security relay. It is activated when certain commands predefined as **Active**—commands that give rise to movements—are activated.

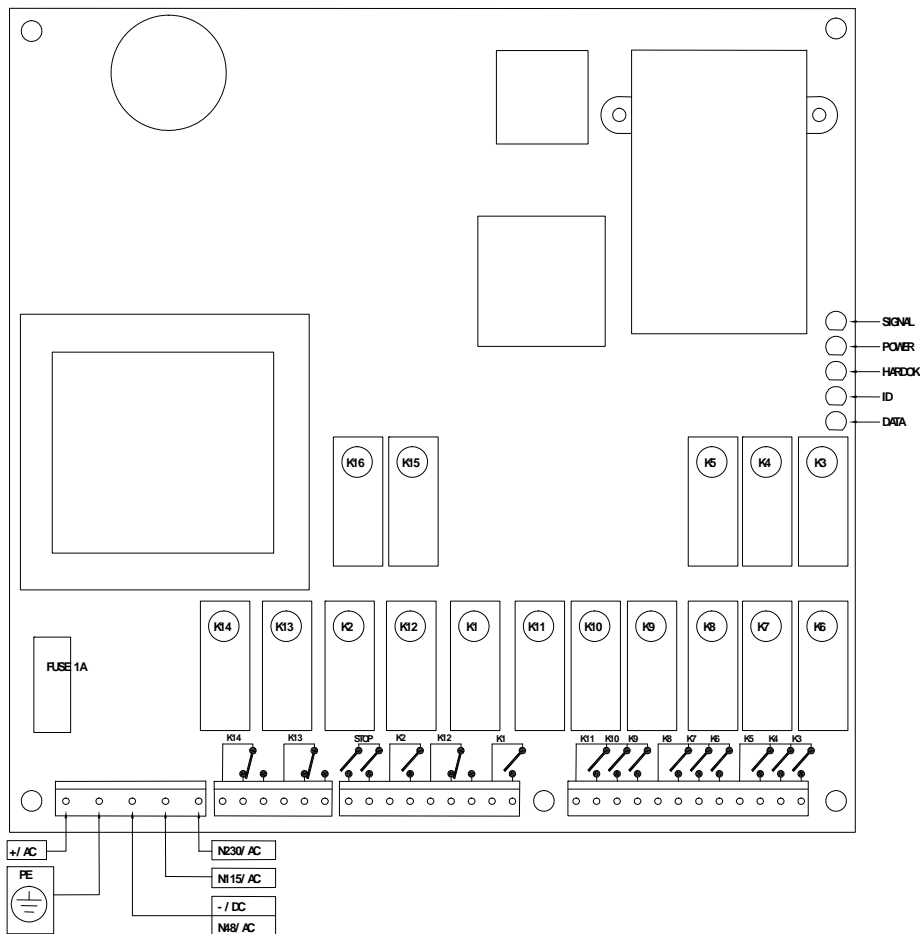


Figure 7. Main Board Connections, Relays, and LEDs

3. Select the **appropriate voltage** on the receiver.
4. Be certain to connect the **ground cable**.

CAUTION



Use only fireproof cables for connections.

3.4 Starting Up

1. Once the receiver has been connected, disconnect the **power supply** to the motors—by removing the fuses for example—and then power up the receiver. The receiver enters into a **SCANNING mode** upon power-up; the receiver LED power-up states are defined in Table 3.

Table 3. Receiver LED States During Power-Up

LED	State	Indication
POWER	ON	Power supply is correct
HARDOK	ON	Absence of faults on the boards
SIGNAL	OFF	Channels are signal free
	Blinks	An RF signal on the channels
DATA	OFF	Another TM70 system is not active in the area
	Blinks	Another TM70 system is active in the area
ID	OFF	System Transmitter not on.

2. Turn the transmitter (Figure 8) **ON** to OPERATION Mode as follows:
 - a. Place a **charged battery** in the transmitter.
 - b. Turn the Contact Key clockwise to **ON**.
 - c. Push in and then pull out the **STOP Button**. The transmitter LED flashes orange once, and then illuminates green for three (3) seconds. If the transmitter has an LCD, it displays the identification of the machine and the battery level.
 - d. Press and hold the **START Button**. The green LED should now light indicating that the transmitter is transmitting. Release the START Button.

At this point the **STOP** relays **K15** and **K16** are energized as long as the TX is active. These relays are typically used to control a main-line contactor, hydraulic pump, or other device that determines that the machinery is on.

The **K2/START** relay is energized when the **START Button** is pushed. It is typically is also connected to a warning device.

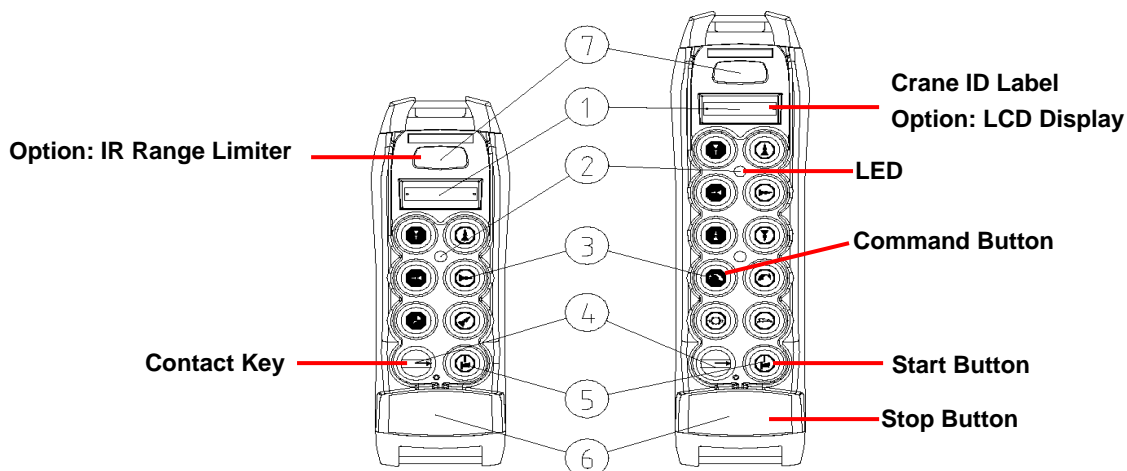


Figure 8. TM70 Transmitter Details

Table 4 below shows the receiver LEDs upon receiving a signal from the transmitter.

Table 4. Receiver LEDs Upon Receiving a Transmitter Signal

LED	State	Indication
POWER	ON	Power supply is correct
HARKOK	ON	Defects have not been detected on the board
SIGNAL	ON	Channels are signal free
DATA	ON	Data received has a correct format
ID	ON	Receiver has recognized the transmitter ID code

- Press any of the transmitter's movement pushbuttons. Its corresponding relay is energized. In case of an active movement, the safety relay **K1/SAFETY** is also energized.
- Check to make sure all the other movements work as described in Step 3.
- Turn off the transmitter using the **STOP Button**, and make sure that when doing so the relays are not energized and the **DATA**, **ID**, and **SIGNAL LEDs** go out. They should behave exactly as when in the SCANNING mode.
- Reconnect the power supply to the motors, move to a safe position, and check to see if all the movement pushbuttons and the STOP Button correctly function.

4.0 Using the System

4.1 General Instructions

Use the following instructions to properly operate the equipment:

7. Attach the harness to the transmitter to prevent the equipment from falling.
8. Make sure of the transmitter you are going to use. Verify that the machine you want to operate matches the transmitter identification label—the label allows the operator to identify the machine before starting the equipment.
9. Install a fully charged battery into the transmitter.
10. Make sure all command controls are in the neutral position. All the command controls associated with active motions must be in the neutral position (inactive) to enable the transmitter.
11. Turn the **ON/OFF key ON** (clockwise) to enable the transmitter.
12. Pull out the **Stop Button**. The LED should pulse green telling you the transmitter is ready for use.

✓ **Note:** *If you find that the Stop Button is already pulled out, you must push it in and then pull it out again. This sequence permits proper operation of the Stop circuit. If the unit has experienced a time-out auto-disconnect, it is not necessary to repeat the Stop Button procedure; instead, push and hold the START Button for one (1) second.*

13. Press and hold the **START Button**. This activates the warning/start alarm if one is installed on the crane/machine and indicates to you the receiver is under your control.
14. The green LED should light indicating that the transmitter is now transmitting. Now when any of the transmitter command pushbuttons are pressed, the corresponding motion is activated.
15. Press the **Stop Button** or turn the **ON/OFF Key** counter clockwise to turn the transmitter **OFF**.

4.2 Battery Level Monitor

TM70 transmitters are equipped with a battery-level monitoring circuit. When the charge level drops below a pre-defined limit, the transmitter LED flashes red indicating the transmitter will **switch OFF** and be disabled in five (5) minutes. When the transmitter is disabled, the machine's main contactor is de-energized. ***If the Stop Button is pushed during this 5-minute warning period, the transmitter will not start again until a fresh battery is installed.***

CAUTION



For safety sake, the load ***must*** be located to a safe position and area during the 5-minute warning prior to Low Battery automatic shutdown. ***Beware: If the STOP Button is pushed during this warning time, you cannot use the transmitter again until a fresh battery is installed.***

4.2.1 LCD Option Power Level Display

Transmitters with the LCD option indicate the battery power level by showing segments—black dashes—in the display. The more dashes shown, the more charged the battery. Power levels are interpreted in Table 5.

Table 5. LCD Power Level Interpretation

Segments Displayed	Battery Charge
Three segments	Greater than 50%
Two segments	Between 10% and 50%
One segment	Between 5% and 10%
None	Less than 5%

✓ **Note:** The transmitter will automatically go to **STAND BY** mode after four (4) minutes of inactivity. Standby mode is indicated by 3-second green LED pulses. Press the **START** Button to restart the transmitter. The 4-minute default can be changed or eliminated through a software modification. If a change is desired, please contact Customer Service.

CAUTION



Keep in mind at all times that you are controlling a moving piece of machinery. You **must** strictly adhere to the safety instructions described in Section 2.0 of this manual.

4.3 Programming a Spare Transmitter

If a transmitter is damaged, it is possible to quickly restore service by transferring the EP70 Memory Module EEPROM from the original damaged transmitter to a similar spare transmitter. This ensures that you use the exact parameters of the original in the spare. The EP70 Memory Module EEPROM is easily accessible from the exterior of the transmitter. To transfer the EP70 Memory Module:

4.3.1 Transfer EP70 From Transmitter to Spare Transmitter

1. The EP70 module is a part of the cover located on the back of the transmitter. Turn the damaged unit over and remove the two screws as shown in Figure 9A. If there is an EEPROM in the spare transmitter, remove the cover screws on it, too.
2. Extract the EP70 module from the damaged transmitter as shown in Figure 9B. Handle module during the transfer by touching only the cover; avoid touching the actual EEPROM located beneath the cover.
3. Install the original transmitter EP70 module into the spare transmitter. The module is keyed so that it will only fit in one way.
4. Install the cover screws on the spare transmitter.

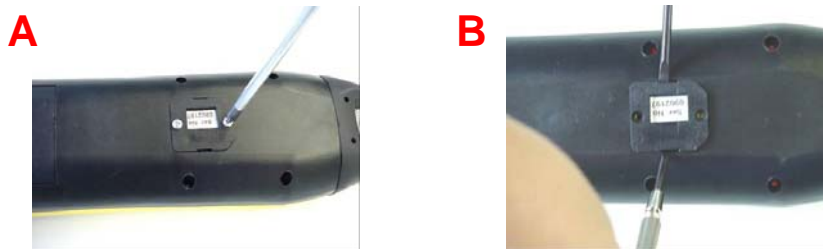


Figure 9. Extracting the EP70 Memory Module

4.3.2 Copy Receiver EP70 to Transmitter EP70

In cases where the damage to the transmitter prevents removal of the resident EP70 module, the spare transmitter can be programmed using the EEPROM module found inside the receiver. To program a spare EP70 using the receiver EEPROM:

1. Remove the cover from the receiver and pull the EP70 from its location by grasping the module by its edges—avoid touching the actual component beneath—and lift the module from its pins by pulling away from the component board. See Figure 10 below for possible EEPROM location.
1. Ensure the spare transmitter is **OFF**. Remove the EP70 Memory Module in the transmitter as shown in Figure 9 above.
2. Insert the EP70 module you removed from the receiver into the **transmitter socket**.
3. Turn on the transmitter **ON/OFF key** to **ON** and pull the **STOP Button out**. The LED will pulse orange, and then green for 15 seconds. See Table 6 below for button function layouts of transmitters.
4. To copy the EP70 Memory Module contents into the internal memory of the transmitter, press transmitter **Pushbutton 6** (see Figure 11) followed by **START**; keep both buttons **simultaneously pressed for five (5) seconds**. The LED will blink orange during the copying process. (In the LCD display models, the word 'Reading...' will display.)
5. When the copying process is complete, remove the receiver EP70 module from the transmitter and replace it into the receiver.
6. Insert the **original transmitter EP70 module** into the transmitter socket. Press transmitter **pushbutton 6** (see Figure 11). The LED will flash orange indicating the resident EP70 Memory Module is being written to with the stored receiver parameters. (In the LCD display models, the word **Writing...** will display.)

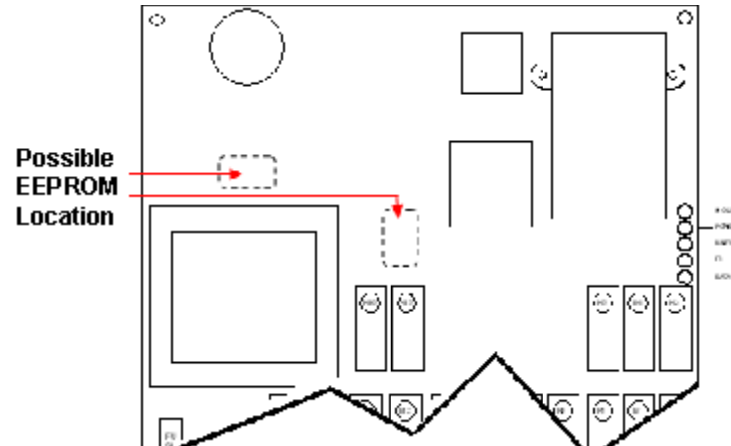


Figure 10. Receiver EP70 Module Location

Table 6. Transmitter Layout

Ref.	Component	Ref.	Component
1	IR Range Limiter (optional)	7	Warning/Start switch
2	LCD (optional)	8	CAT3 Stop switch
3	Diagnostic LED	9	Shock absorbers
4	Two-step pushbuttons	10	Portable EEPROM
5	Maintained or spring return switch	11	Battery
6	Safety key switch		

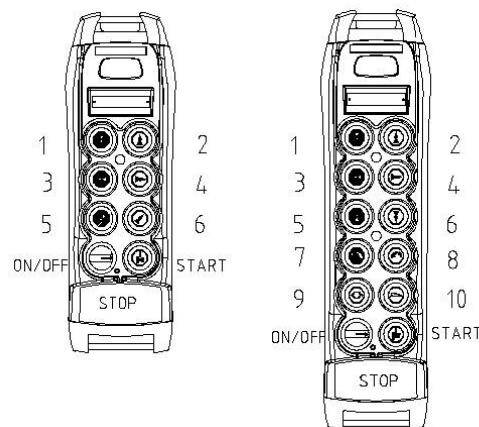


Figure 11. TX Pushbutton/Switch Numbers/Names

4.4 Programming the Machine Identification in LCD Transmitters

Transmitters with the optional LCD display permit the operator to program a machine identification label of up to 24 characters. The identification displays upon transmitter start-up.

You can edit/introduce this text as follows when first starting the transmitter (see Figure 12):

1. Install a battery and turn the **ON/OFF key** to **ON**.
2. Push in and then **pull out** the **STOP Button**. You the LED should pulse orange followed by green pulses.
3. Press **pushbutton 4** to the second step and then push the **START Button**. Keep both pressed simultaneously for 2 seconds. You will enter the **EDITING** mode.
4. Once you have entered the EDITING mode, the display will show **CRANE ??** with the first character blinking. From this point you can edit the name of the machine using pushbuttons 1 to 4. Button functions are as follows:
 - Pushbutton 1: Scroll the list of established characters in **descending order**.
 - Pushbutton 2: Scroll the list of established characters in **ascending order**.
 - Pushbutton 3: Return to the **previous character** in the display.
 - Pushbutton 4: **Validate** the displayed character and move to the next character to the right.
 - Push **START** to store the edited text. LCD will show the message **SAVED** for two (2) seconds.
5. Once the last character has been edited, exit EDITING mode by pressing the **STOP Button**.

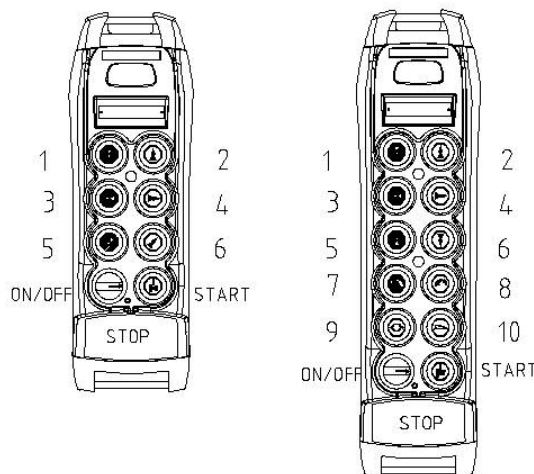


Figure 12. Transmitter Button Locations

4.5 LCD Display Analog Feedback Calibration

Analog feedback systems must have the Display and Analog Feedback options. The analog input must be calibrated upon startup. Transmitters with the display option allow the operator to calibrate the analog input using the display three digit value and a comma; and, a measurement unit of up to three characters.

✓ **Note:** *Calibration generates a linear interpolation of the possible values. This means that it can be used with all systems that generate a linear analog output. For non-linear systems, the interpolation will display an incorrect value.*

4.5.1 Calibrating Analog Feedback

The transmitter must be within operating range of the receiver during this procedure. Use Figure 12 to reference pushbutton and key switch locations on the transmitter.

1. Insert a fully charged battery into the transmitter and turn the **Key Switch** to **ON**.
2. Push and then pull-out the **STOP Button**.
3. Place a known load on the crane to introduce the first value.
4. Enter the **Calibration mode** by pressing **Pushbutton 4** to the second speed; continue to hold the button down.
5. Push and hold the **START Button** simultaneously with the **pushbutton 4** until **CONFIG** appears on the display.
6. Press **Pushbutton 4** to enter the **MENU**.
7. Use **Pushbuttons 1** and **2** to navigate through the menu until you find **CALIBRATION**.
8. Press **Pushbutton 4** again. You will enter a Calibration submenu where you can navigate to selections **Value 1**, **Value 2**, and **Units** by using **Pushbuttons 1** and **2**.
9. Navigate to the desired submenu, **Value 1**, and press **Pushbutton 4** to enter that submenu. Note that the receiver will start up, but you will not have control over crane motion. The transmitter must communicate with the receiver in order for the information from the analog input to be sent to the transmitter. While in a submenu, you can use Pushbuttons 1 through 4 as follows:
 - **Pushbutton 1** – Used to move through character list in descending order.
 - **Pushbutton 2** – Used to move through the character list in ascending order.
 - **Pushbutton 3** – Used to return to the previous character in the list.
 - **Pushbutton 4** – Used to select the chosen character for that digit position and move to the next digit position.
10. Once a corresponding value is assigned to the suspended load, the display will show three digits plus a comma. Make sure the value displayed is accurate.

11. Press the **START Button** to **Save** the displayed value. The value will be memorized for that calibration item. Communication with the receiver will stop.
12. Press **Pushbutton 1** to return to the previous menu to edit the **Units**. Units can be no more than three (3) characters.
13. Press **STOP** and restart the crane. Replace the current load with another known load.
14. Repeat process **Steps 9** through **12** to calibrate **Value 2**.
15. Press **STOP** and restart the crane.

The system will now be ready for service.

- ✓ **Note:** *Data appearing in the display will be inconsistent and unreliable until calibration is performed.*
- ✓ **Note:** *Calibration allows negative values.*
- ✓ **Note:** *Modified feedback calibration data is not automatically updated in the receiver EEPROM. The new information must be copied from the transmitter EEPROM into the receiver EEPROM.*

Calibration Example of a Load Cell

1. Get into **Calibration mode**. Enter **Value 1** to represent the hook with no load.
2. Press **START** to validate the entry. Turn the transmitter **OFF**.
3. Start the system again and raise a known load.
4. Turn the transmitter **OFF** and then restart.
5. Enter Calibration mode again. Set **Value 2**.
6. Press **START** to validate the entry.
7. Press **Pushbutton 1** to edit the Units.
8. Press **START** to validate the Units.
9. Turn the transmitter **OFF**.

The equipment should now be calibrated and ready for use.

4.6 Range Limiter

TM70 radio remote control systems LA70 Infrared Range Limiter transmitter option prohibits the system from being operated outside a defined working area. The operator must be within *Line-Of-Sight* of the LA70 transmitter to control the machine.

The system consists of one or more LA70 Infrared transmitters. The LA70 transmitter is installed in a fixed position or on the controlled crane and positioned to cover the

targeted working zone as shown in Figure 13. Range Limited TM70 RF transmitters are equipped with an infrared sensor that receives the information from the LA70 transmitter, analyzes the information, and then acts as a permissive. If the transmitter does not receive the infrared data within a pre-determined time (factory setting is four (4) seconds), the outputs are deactivated.

Figure 13 shows some LA70 IR Range Limiter application examples.

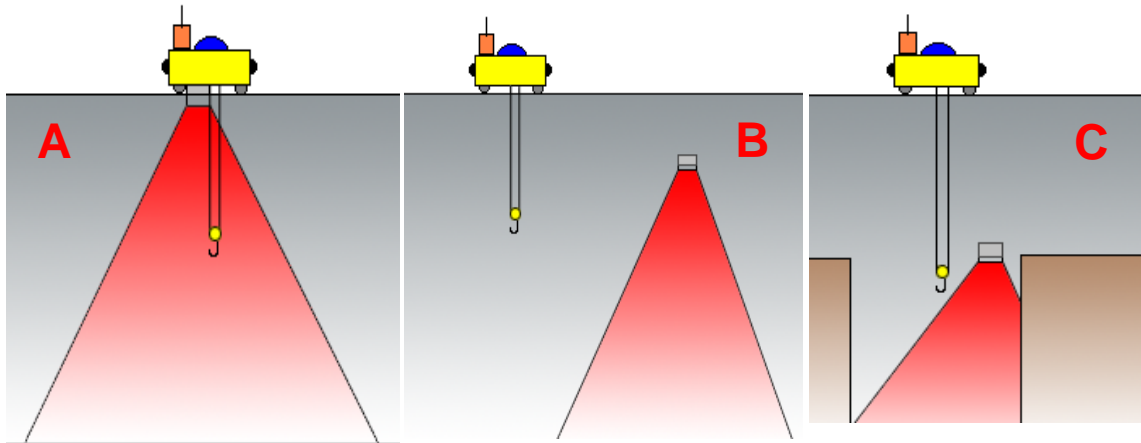


Figure 13. Range Limiter Application Examples

4.6.1 Infrared Sensor

As the system or operator moves, an infrared sensor located in the TM70 remote control transmitter receives infrared information as it is transmitted from the LA70 transmitter. The remote microprocessor gathers the sensor information and checks for the crane or machine ID. If the operator is too far away from the LA70, the sensor stops receiving an IR signal and the TM70 transmitter LED begins to flash RED warning the operator that the sensor must be back within signal range within four (4) seconds (the system default). If the operator fails to get back into range within the allotted time, all active commands are stopped; however, the RF communication is maintained with the receiver and remains in control of the main-line contactor and the selection commands.

The operator must move the TM70 transmitter into the defined working area, or zone, to regain control the crane or machine. Movement commands must be disabled and reestablished for control. Transmitters having displays will show the message "Out of Range" while the transmitter is beyond working range.

Four (4) modes of operation are defined in the EEPROM:

1. **Range Limiter Only At Startup (Electronic Key):** The transmitter must be within the define control zone upon startup.
2. **Range Limiter Only In Operation:** The transmitter can be started anywhere, but control will only occur when the transmitter is within the defined limits of the sensors.
3. **Range Limiter At Startup And Operation:** The transmitter functions only within the sensor limited range.

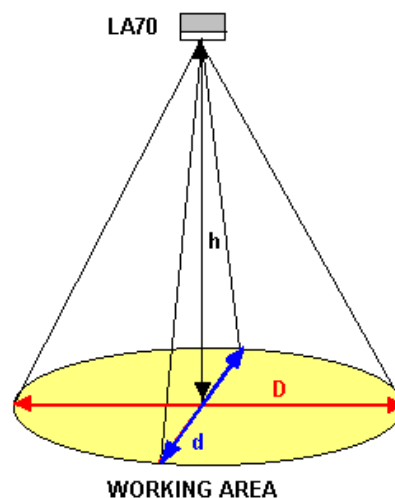
4. **Range Limiter Only As An Output Relay:** The transmitter does not indicate if it is in or out of range, but it does not mask an order. Information will be sent to the receiver to process as an output command, or as an output condition in the relay table.

4.6.2 Infrared Transmitter

The Infrared Transmitter installed on the crane

Figure 14. IR Limiter Working Area

h (m/ft)	D (m/ft)	d (m/ft)
6/19.7	24/78.7	10/32.8
8/26.3	32/104.9	13/42.7
10/32.8	40/131.2	17/55.8
12/39.4	48/157.5	20/65.6
14/49.9	56/183.7	23/76.46
16/52.5	64/210	26/85.3
18/59	68/223.1	29/95.1
20/65.6	70/229.7	32/105



The working area is elliptical, and the area of influence is determined by how high above the ground the IR transmitter is installed; the higher the transmitter, the greater the area of influence. If the area of control is determined to be larger than that provided by the LA70, multiple LA70s can be installed to increase the control area.

4.6.3 Installation

CAUTION



Make sure that the crane is switched OFF during assembly and installation.

Make sure that the area is clear and proper safety apparel is used.

Make sure that the power supply to the crane is disconnected.

Make sure the earth ground cable is attached.

Use flame resistant cable for all connections.

- Install the unit away from anything that can generate intense electrical disturbances and light transmission.
- Use the proper power supply.
- Place the selector jumper in the MASTER position.
- Select the desired programmed code in the transmitter EEPROM.
- Communication wiring between multiple LA70 transmitters must be made using shielded wires.

In those cases where it is necessary to use more than one LA70 transmitter, connect subsequent transmitter in series with each transmitter selector set as SLAVE.

4.6.4 Technical Characteristics of the LA70

Infrared Transmitter

Power Supply	48, 115, 230VAC \pm 10%; 50/60Hz
Operation Temperature	-10 to +65°C
Protection	IP55

5.0 Maintenance

5.1 Precautions

This equipment is designed for use in an industrial environment. However, we recommend you follow the instructions below to extend the life span of your remote control system.

- Use the harness provided with the transmitter to prevent the transmitter from falling.
- Do not clean the transmitter with solvents or pressurized water. Use a damp cloth or soft brush.
- Use and recharge the battery regularly as per the guidelines of Topic 3.1 above and Topic 3.2 above.
- ***Check that the STOP Button is working every day.***
- Disconnect the receiver cables if welding is necessary on the machine.
- Periodically check the condition of the transmitter rubber seals. Replace immediately if they show signs of deterioration to ensure they remain watertight.
- Clean the battery contacts.

5.2 Fault Identification

Both the transmitter and receiver have status monitoring LEDs that help to identify failures. The most common signals are contained in the tables below.

5.2.1 Transmitter

Table 7. Transmitter Status LED Fault Identification

LED	Indication
Solid Green	Transmitter transmitting normally. OPERATION Mode.
Green Pulses	Transmitter ready for Start-up. STAND BY Mode.
Red – Slow Flashing	Battery level low.
Red – Fast Flashing	EEPROM module is not plugged in.
Red – Double Flashing	Transmitter cannot start up because a motion command is present.
Red – Solid	Transmitter failure.

5.2.2 Receiver

In **OPERATION mode** the five LED's must be lit as has described in section 3.4. If this condition exists, press the transmitter motion pushbuttons and observe the response of the output relays.

- If the response is normal, the problem is not related to the remote control equipment and the installation must be evaluated.

- If any of the relays are not activated, the problem is associated with the remote control equipment. Observe the status of the LED's and reference Table 8 to determine the problem source.

Table 8. Receiver Status LED Fault Identification

LED	LIT	ON	OFF
SIGNAL	RF signal OK	RF signal detection in SCANNING Mode	The receiver is not receiving RF signals
POWER	Power Supply OK		Power Supply NOT OK
HARDOK	Board OK	Slow: fault in the board Fast: error in EEPROM	Fault in the board
ID		ID Code OK1	ID NOT recognized
DATA		Is receiving the correct data from a TM701	Fault in the board

¹ DATA and ID LED's show a weak flashing when data and the ID code are received correctly but the Start command has not yet been received. Once START Button is pushed ON the DATA and ID LED's will show the standard strong flashing.

5.3 Returning Equipment for Repair

If you find a problem with the equipment:

1. Contact our Customer Service.
2. Discuss your problem with the Cervis technician. In many cases the problem can be resolved over the telephone and thus not require you to return any equipment.
3. When equipment is determined to need service, the technician will issue an Return Material Authorization (RMA) number to you.
4. Return the defective device to our Customer Service Department. Please:
 - Include a description of the problem and the status of the LEDs.
 - Clearly mark your issued RMA number on the **outside** of the package.

✓ **Note:** Please address all equipment returned to Cervis, Inc. to the attention of our Technical Service Department, together with a description of the problem and the status of all LED's. It is our intention to make the necessary repairs quickly and return the system to you as soon as possible.

✓ **Note:** If the transmitter becomes inoperable, a spare can be quickly substituted by following the instructions in APPENDIX A.

5.4 Spare Parts

Table 9. Available Spare Parts

Item	Part	Code
Transmitter	TM70/1	2301090
	TM70/2	2301091
	TM70/1 with Display & IR Sensor	2301090-B4-DLA
	TM70/2 with Display & IR Sensor	2301091-B4 DLA
Transmitter Boards	LE71/915	2303881
	LE71/915/DLA (units with display or IR)	2303901
	LE72/915	2303884
	LE72/915/DLA (units with display or IR)	2303904
Receivers	R70/13	2301092
	R70/21	2301093
	R70/29	2305087
Receiver Boards	LR71/915 (120VAC)	2303887
	LR71DC/915 (24VDC)	2303893
	LR72/915 (120VAC)	2303890
	LR72DC/915 (12VDC)	2303896
Electronic Circuits	R8 CAN (8 relay)	2303739
	IN 0-10V	2303755
	IN 0-450P (expansion)	2303758
	EP70 EE-Prom	2303743
	EE-prom modification	2300300
Misc. Parts	Pushbutton P70	2303670
	Pushbutton cover CP70	1152023
	Spring return switch 1-0-1 M70	2303770
	Maintained switch 1-0-1 S70	2303760
	Key lock K60	2300170
	Emergency STOP pushbutton EMS60	2305127
	Upper part PS70/1 SM	2303780
	Upper part PS70/2 SM	2303790
	Upper part PS70/1 DLA (display/IR, Stop, and buttons)	2303801
	Upper part PS70/2 DLA (display/IR, Stop, and buttons)	2303811
	Lower part PI70/1	2303677

Item	Part	Code
Misc. (cont.)	Lower part PI70/2	2303678
	Upper Transmitter Bumper	1151051
	Lower Transmitter Bumper	1151052
	Battery BT06K	2303692
	Battery charger CB70, (without power supply)	2305002
	Power supply for CB70, 115VAC	1106027
	12VDC Power Adapter (lighter housing) for CB70	1095824
	12VDC Lighter Connector for CB70	1095825
	Shoulder Strap/Harness B60C (padded)	1175030
	Protective case TM70/1 transmitter (Bag)	2305010
	Protective case TM70/2 transmitter (Bag)	2305011
	Receiver shock absorbers	1166074
	Shoulder Strap B70 (for handheld transmitter)	1175022
	TM70 Antenna Extension Cable (10ft.)	Please call Cervis for part number: (724) 741-9000
	External Antenna Adapter	
	Antenna Mounting Plate/Ground Plane	
	TM70 External Antenna	
	Internal Antenna	2303720
Icons	Standard Set: three white arrows; three black arrows; one Start/Horn	2303845
	TM70/1 Blank	2303847
	N, S, E, W; Up-Down Arrows; Start/Horn	2303848

✓ **Note:** The Available Spare Parts table may change without notice. For pricing, and availability, please go to our Web site at www.cervis.net for contact information; or, email Cervis Sales directly with you inquiry at www.sales@cervis.net.

5.5 Common Spare Parts Identification (limited)

The following information can be used to correctly identify common parts you may need before placing an order.

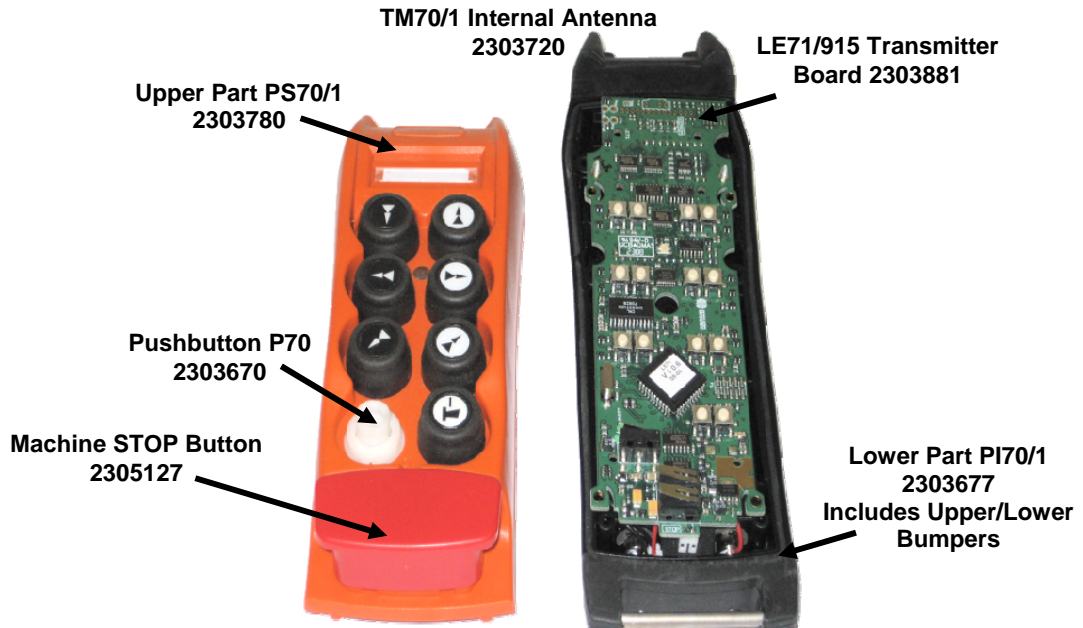


Figure 15. TM70/1 2301090 Pushbutton Transmitter

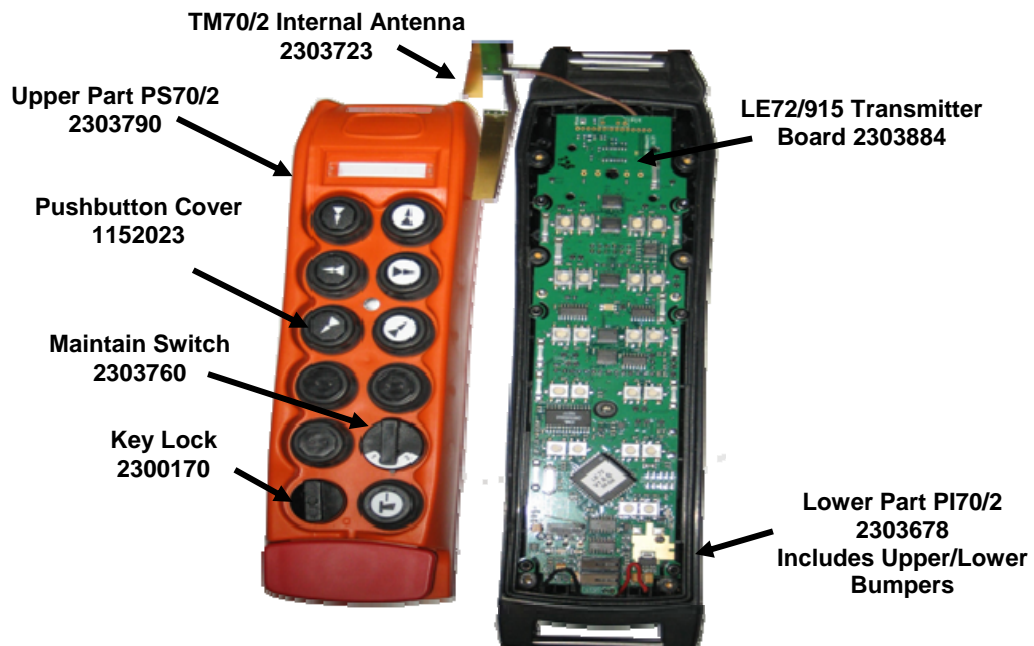
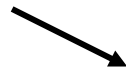


Figure 16. TM70/2 2301091 Pushbutton Transmitter

**LE71/915 DLA Transmitter Board
2303901**



**Set of Standard TM70 Icons
2303845:**

- 3 White Arrows**
- 3 Black Arrows**
- 1 Start/Horn**



Figure 17. TM70/1 2301090-B4-DLA Display Handheld Transmitter

**LE72/915 DLA Transmitter Board
2303904**



Figure 18. TM70/1 2301091-B4-DLA Display Handheld Transmitter



Both Upper Parts include all pushbuttons and a mounted STOP switch.

Figure 19. PS70/1 DLA Upper 2303801 and PS70/2 DLA Upper 2303811

6.0 Warranty

Subject to the limitations below, Cervis warrants all of its products to be free from material defects in material and workmanship. However, Cervis liability under such warranty shall be limited to repair or replacement of any product which Cervis' inspection shall disclose to have been defective. This warranty does not apply to any products, which have been subject to abuse, mishandling, or improper use, and does not include field labor of any type. Cervis' quotation does not include price provision for performance bond of indemnity. Therefore, the additional cost incurred to provide such a bond shall be added to the total amount of the quote and paid by Purchaser. The warranty period for the TM70 series equipment shipped hereunder is one (1) year and covers all labor and materials manufactured by Cervis provided the Purchaser returns them to the factory for repair. Defective items under warranty will be repaired or replaced free of charge at Cervis' discretion, during the one (1) year term of this warranty. Freight and/or postage are not covered by said warranty and will be paid by the purchaser. Any services rendered in the field will be performed at current rates for time and travel at the discretion of Cervis and will be paid by the purchaser. All TM70 products of Cervis carry a warranty period of one (1) year. Batteries, cases, switches, faceplates, foils, and such other items subject to normal wear and deterioration are not included in the warranty. Cervis' warranty period begins at system receipt after direct shipment to Purchaser.

IN NO EVENT WILL CERVIS BE LIABLE FOR INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. EXCEPT AS STATED ABOVE, CERVIS MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESSED OR IMPLIED, NO OTHER REPRESENTATION OR WARRANTY IS GIVEN, AND NO AFFIRMATION OF CERVIS OR ITS REPRESENTATIVES BY WORD OR ACTION SHALL CONSTITUTE A WARRANTY. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE ONE (1) YEAR PERIOD DESCRIBED HEREIN. CERVIS SPECIFICALLY DISCLAIMS, AND PURCHASER HEREBY WAIVES, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE.

The warranty does not cover damage resulting from the following:

- transport
- incorrect installation
- repairs or alterations made by personnel other than from CERVIS
- obvious misuse or incorrect maintenance of the equipment.

Our Technical Service reserves the right to evaluate all break-downs and damage to determine warranty

Under no circumstances will CERVIS be held responsible for delays or work stoppage, accidents or expenses incurred as a result of equipment malfunctioning.

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